

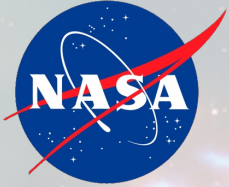


The Physics of the Cosmos Program Office

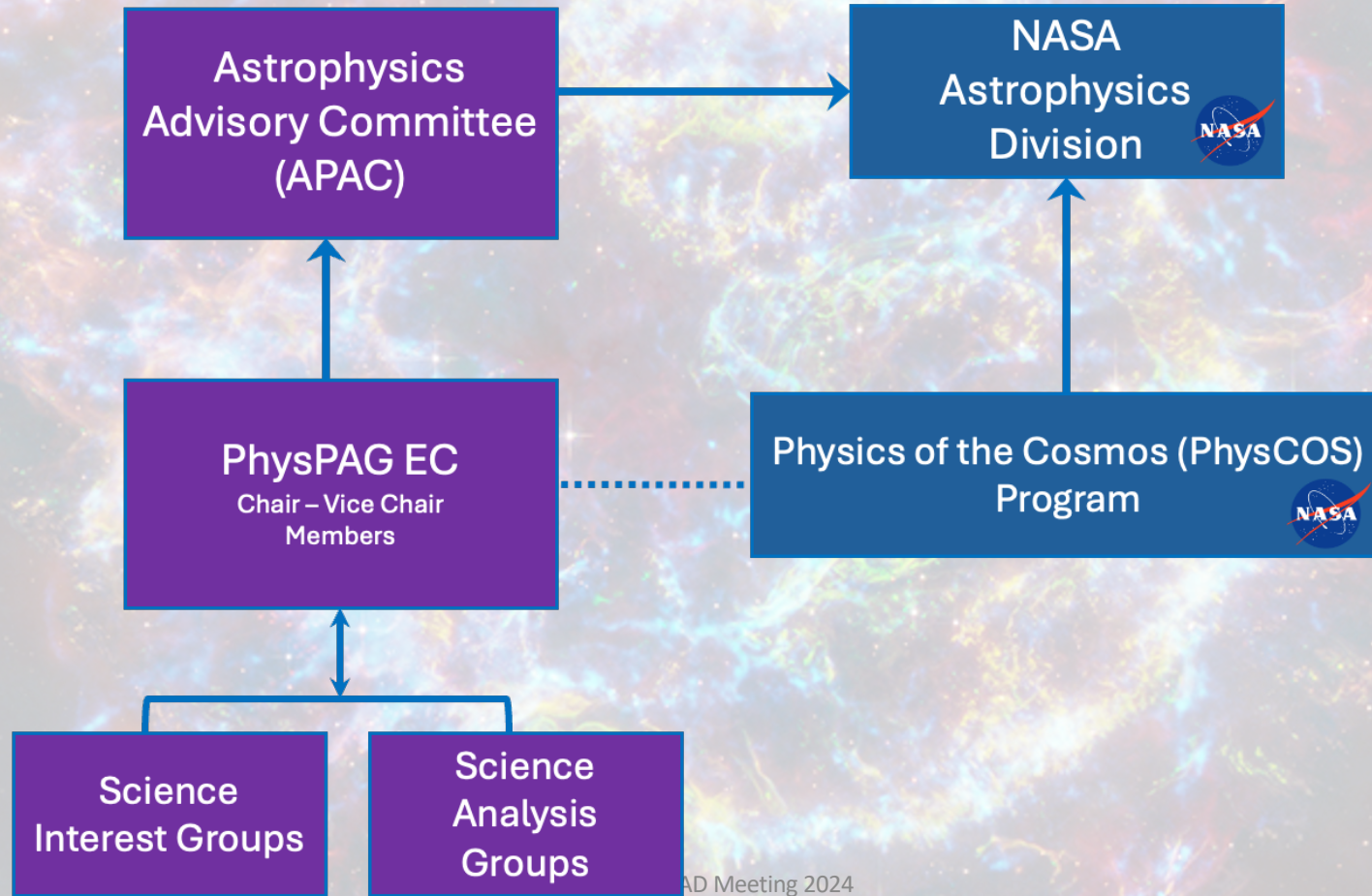
Francesca Civano and Brian Humensky

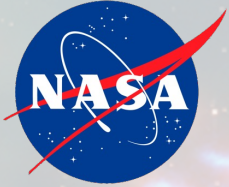
Chief Scientists, PhysCOS





Phys... What?!?

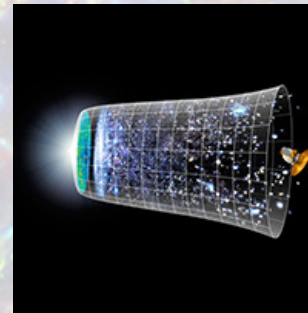
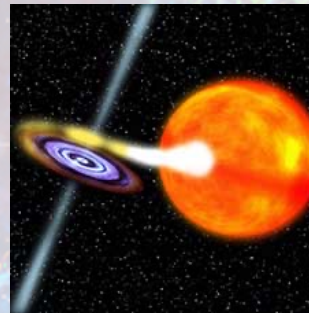
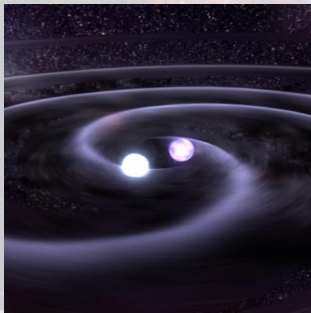




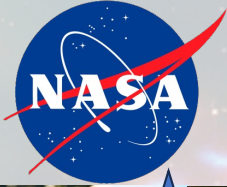
The PhysCOS Program Office



Physics of the Cosmos spans the fields of high-energy astrophysics, cosmology, and fundamental physics, to explore some of the most fundamental questions regarding the physical forces and laws of the universe:



- Manages strategic technology development
- Provides a two-way communication conduit between community & NASA
- Works with sibling program offices: **Cosmic Origins** and **Exoplanet Exploration**



NASA Physics of the Cosmos (PhysCOS) and Cosmic Origins (COR) Programs



Brian Humensky

Francesca Civano

Program Management
 Program Manager: Barbara Grofic
 Deputy Program Manager: Cathy Barclay
 Program Business Manager: Tracy Felton-Robinson
 Administrative Assistant: Susan Wright

Resources Management Group
 Deputy Program Business Manager: Patricia Smith
 Programmatic Officer: Patricia Butler*
 RA's: Jessie Hughes*, Ryan Bradley*

Procurement Support:
 Space Science Procurement Manager: Malika Graham

Program Support
 IPTL: Patricia Butler* PSM: Mary Dobay*



Barbara Grofic



Cathy Barclay

Strategic Studies & Implementation

Program Science
 PhysCOS Chief Scientists: Dr. Francesca Civano, Dr. Brian Humensky
 COR Chief Scientist: Dr. Peter Kurczynski
 Deputy COR Scientist: Dr. Swara Ravindranath*¹
 PhysCOS/COR Science PSM: Stephanie Clark*

Program Technology & Systems Engineering
 Program Systems Engineer: Dr. Mark Matsumura[^]
 Technology Development Manager: Rachel Rivera
 Chief Technologist: Jason Derleth²
 Program Technologist: Dr. Opher Ganel*



Mark Matsumura

Fornax Initiative
 Initiative Manager: Patrick Coronado*
 Lead Scientist: Dr. Tess Jaffe
 Deputy Scientist: Dr. Francesca Civano

TDAMM ACROSS Initiative
 Initiative Manager: Dr. Chris Roberts
 Study Scientist: Dr. Brian Humensky
 Systems Engineer: Dr. Mark Matsumura

LISA Study
 Study Manager: Terry Doiron
 Study Scientist: Dr. Ira Thorpe
 System Engineer: Norman Rioux[^]

ATHENA Study
 Study Manger: Dr. Mark Matsumura (Acting)
 Study Scientist: Andy Ptak
 Deputy Study Scientist: Kristin Madsen
 Systems Engineer: Robert Studer*

ULTRASAT MOU Implementation
 Initiative Manager: Barbara Grofic
 Deputy Initiative Manager: Cathy Barclay
 Initiative Scientist: Dr. James Rhoads
 System Engineer: Dr. Mark Matsumura



Bernard Kelly



Stephanie Clark



Valerie Connaughton



Sanaz Vahadinia

HQ Program Executive: Shahid Habib
 HQ Program Scientist: Valerie Connaughton
 HQ Dep. Program Scientist: Sanaz Vahadinia



Rachel Rivera



Jason Derleth

*Contractor
[^]Independent Technical Authority Habitable Worlds Observatory/GOMAP
¹ START Member (Ex-Officio)
² TAG Member (Ex-Officio)



PhysCOS Program Office Activities



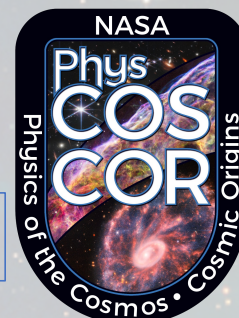
- The program office supports the community by
 - Facilitating the PhysCOS Program Analysis Group (PhysPAG);
 - Supporting the activities of Science Interest and Analysis Groups (SIGs and SAGs)
 - Informing members of upcoming funding and engagement opportunities;
 - Soliciting community-identified science and technology gaps;
 - Managing funded technology projects with benefits to PhysCOS science;
 - Maintaining science cognizance to enable more successful NASA strategic planning;
 - Community engagement: AAS, HEAD, APS, SACNAS, NSBP, ...
 - Supporting mission studies: LISA just went through adoption and NewAthena is returning to the PO.



21st HEAD Meeting 2024



PhysCOS Program Analysis Group Executive Committee



R. O'Brient – JPL

V. Miranda – Stony Brook

**YEARLY call for new EC members:
PLEASE CONSIDER TO JOIN!**

★ M. E

★ B. Gre

XR SIG

A. Corsi – TTU
GW SIG

★ D. Pooley – Trinity U.
XR SIG – Vice Chair

★ E. Burns – LSU
TDAMM SIG

★ C-T. Chen - USRA
XR SIG

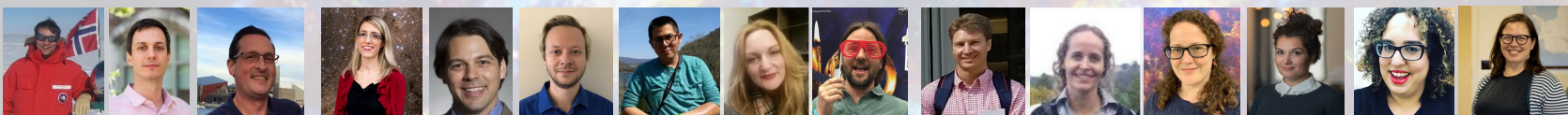
★ A. Meli – NC A&T
CR SIG & Chair

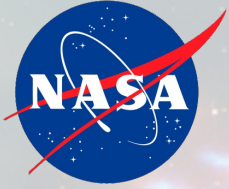
Stephanie Wissel - PSU
CR SIG

K. Madsen - GSFC
XR SIG

J. Finke - NRL
GR SIG & Chair Emeritus

J. Perkins - GSFC
GR SIG





<https://pcos.gsfc.nasa.gov>



Site QR Code:



The screenshot shows the PhysCOS website interface. At the top is a navigation bar with links: Home, PhysPAG, Science Interest Groups, Science Analysis Groups, Mission Studies, and Resources. The PhysPAG dropdown menu is open, listing: Executive Committee, Science Gaps, Cosmic Pathfinders, Meetings, and Events Calendar. The main header features the text "Physics of the Cosmos" and "Exploring fundamental questions regarding the physical forces of the universe". Below this is a secondary navigation bar with buttons for PhysPAG Home, PhysPAG Chairs, Presentations, and Reports. The main content area is titled "Physics of the Cosmos Program Analysis Group (PhysPAG)" and includes sections for Objective, Terms of Reference, and a News sidebar.

PhysPAG Home | **PhysPAG Chairs** | **Presentations** | **Reports**

Physics of the Cosmos Program Analysis Group (PhysPAG)

Objective

The PhysPAG serves as a community-based, interdisciplinary forum for soliciting and coordinating community analysis and input in support of Physics of the Cosmos objectives and of their implications for architecture planning and activity prioritization and for future exploration. It provides findings of analyses to the NASA Astrophysics Division Director.

The PhysPAG enables direct regular communication between NASA and the community, and within the community, through public meetings that give the community opportunities to provide its scientific and programmatic input. Structurally, the PhysPAG Chair and the [PhysPAG Executive Committee \(EC\)](#) are appointed members whose responsibilities include organizing meetings and collecting and summarizing community input with subsequent reporting to the Astrophysics Division Director. The full PhysPAG consists of all members of the community who participate in these open meetings. The PhysPAG has six Science Interest Groups (SIGs), described in more detail at [PhysPAG SIGs](#).

Terms of Reference

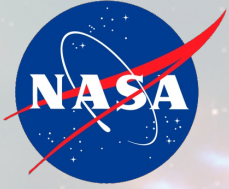
For more information on the operation and organization of the PhysPAG, please see the signed PhysPAG Terms of Reference (updated March 2017) [[PDF](#)].

News

- 2 April 2024**
PhysCOS Activities at APS April Meeting
» [Details](#)
- Release of the Second COSI Data Challenge and Analysis Tools
» [Details](#)
- [More News Articles »](#)
- [Subscribe to PhysCOS News »](#)

Mailing List QR Code:





Site QR Code:



<https://pcos.gsfc.nasa.gov>

The screenshot shows the website's navigation menu with 'Science Interest Groups' selected. The main header reads 'Physics of the Cosmos' with the tagline 'Exploring fundamental questions regarding the physical forces of the universe'. Below the header are two buttons: 'Science Interest Groups' and 'Science Analysis Groups'. The 'Science Interest Groups (SIGs)' section is active, displaying a list of current SIGs.

Science Interest Groups (SIGs)

Science Interest Groups (SIGs) are standing groups of scientists with interests in a certain area of astrophysics. SIGs provide quantitative metrics and assessments to NASA in regard to current and future needs of the community in that area, and act as a focal point and forum for the community.

Most SIGs operate within one of the three themes of NASA Astrophysics — [Physics of the Cosmos](#), [Cosmic Origins](#), and [Exoplanet Exploration](#) — but some encompass all astrophysics themes.

All PhysCOS SIGs are chaired by one or more members of the [PhysPAG Executive Committee](#). Anyone subscribed to a SIG's mailing list is considered a member of the SIG.

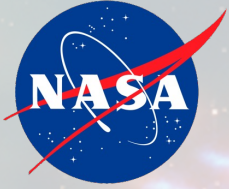
Current SIGs

- [Cosmic Ray \(CR SIG\)](#) (Chairs: Andrew Romero-Wolf and Athina Meli): Coordinate community activities and preparations for a future cosmic ray astronomy mission.
- [Cosmic Structure \(CoS SIG\)](#) (Chairs: Vera Gluscevic and Rebekah Hounsell): Coordinate community activities for future space activities concerning the nature of dark energy, dark matter, neutrinos, and tests of inflation, as well as astrophysical galaxy evolution.
- [Gamma Ray \(GR SIG\)](#) (Chairs: Justin Finke, Eric Burns, and Manel Errando): Coordinate community activities and preparations for a future gamma ray astronomy mission.
- [Gravitational Wave \(GW SIG\)](#) (Chairs: Chiara Mingarelli and Alessandra Corsi): Coordinate community activities and preparations for a future gravitational wave mission.
- [Inflation Probe \(IP SIG\)](#) (Chair: Roger O'Brient): Coordinate community activities and preparations for a future cosmic microwave background polarization mission.



Mailing List QR Code:





Site QR Code:



<https://pcos.gsfc.nasa.gov>

Home PhysPAG Science Interest Groups Science Analysis Groups Mission Studies

AWESOM SAG
Future Innovations in Gamma Rays SAG
New Great Observatories SAG
TDAMM Communications SAG
Completed SAGs

Physics of the Cosmos

Exploring fundamental questions regarding the physical forces of the universe

Science Interest Groups Science Analysis Groups

Science Analysis Groups (SAGs)

Science Analysis Groups (SAGs) are groups of scientists convened for a finite period of time (usually one or two years) to address a specific question of interest to NASA astrophysics. The SAG activity aims to produce one or more reports at the end of its term that will be delivered to the Astrophysics Division Director. SAGs can be formed in response to questions that emerge from discussions within a SIG or in response to a request for information from the Astrophysics Division Director.

Many SAGs operate across multiple astrophysics themes, with chairs selected from the community.

Current SAGs

- [Astrophysics With Equity: Surmounting Obstacles to Membership \(AWESOM\) \(Cross-PAG\)](#). Contact: Ryan Hickox (ryan.c.hickox@dartmouth.edu).
- [Future Innovations in Gamma Rays Science Analysis Group \(FIG SAG\)](#). Contacts: [FIG SAG Chairs](#)
- [New Great Observatories \(Cross-PAG\)](#) Contacts: the PhysPAG, COPAG, and ExoPAG Chairs (Grant Tremblay: grant.tremblay@cfa.harvard.edu; Janice Lee: janice.lee@noirlab.edu; Ilaria Pascucci: pascucci@arizona.edu, respectively).
- [TDAMM Communications SAG](#) Contacts: Co-Chairs Jamie Kennea (Penn State) and Judy Racusin (NASA GSFC).

2 April 2024
PhysCOS Activit Meeting
» Details

Release of the S Challenge and A
» Details

[More News Article](#)

[Subscribe to Phys](#)

<https://pcos.gsfc.nasa.gov/sags/sags.php>

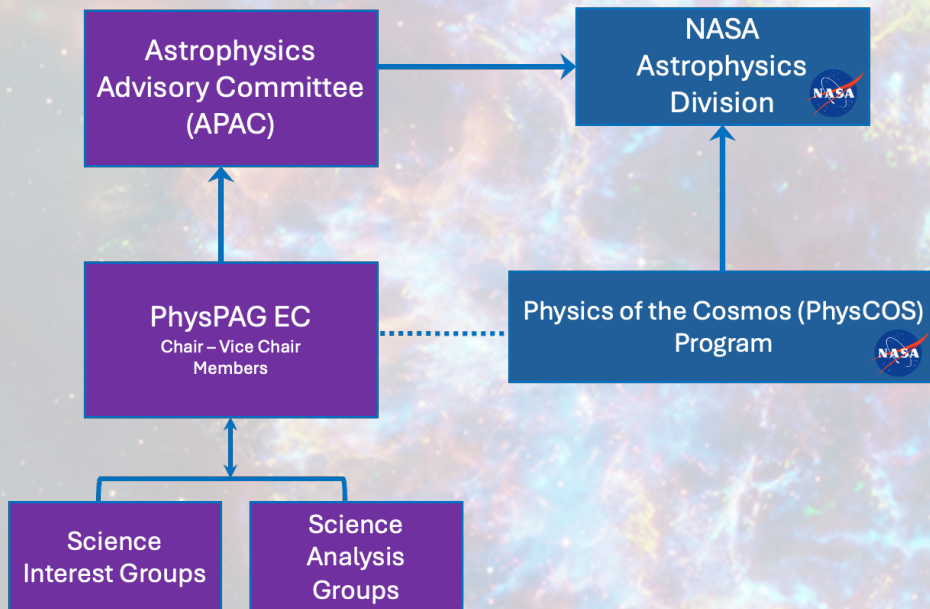


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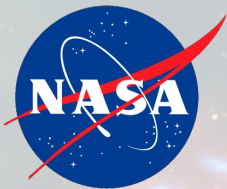




Science Interest Groups & Science Analysis Groups



- **Science Interest Groups** are community-led affinity groups focused on a particular area that are long-term.
 - Meet regularly to discuss science and technology developments, concerns in field
- **Science Analysis Groups** are stood up for a short term (1-2 years) to analyze a specific issue and deliver a report to APAC & Astrophysics Division.
 - Proposed by SIGs or requested by HQ
 - Membership open to any who are interested



Science Interest Groups & Science Analysis Groups



Science Interest Groups (SIGs)

Science Analysis Groups (SAGs)

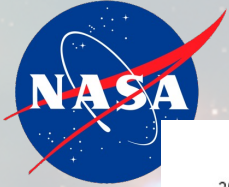
Cross-PAG

Inflation Probe	Gravitational Wave	TDAMIM	New Great Observatories	Gamma Ray Transient Network Complete
X-ray	Cosmic Structure	HWO	AWESOM	Space Communications
Gamma Ray	Cosmic Ray			Future Innovations in Gamma Rays New

- New T
- Scienc
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**Interested in forming a new SAG?
Let's talk!**

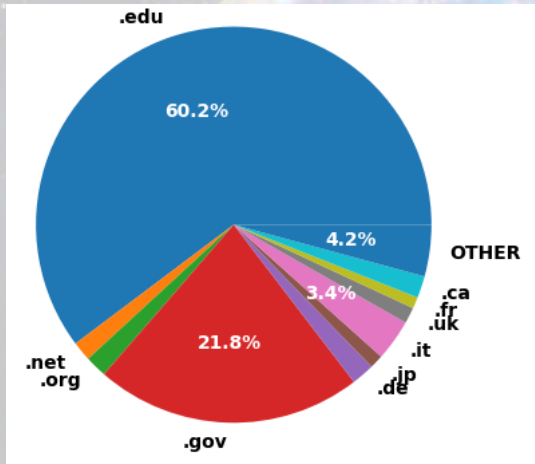
Community Engagement



>30% INCREASE

SIG Subscribers		
	2023	2024
CR	78	138
CoS	71	169
GR	242	309
GW	396	514
IP	122	151
XR	189	268
TDAMM	15	119

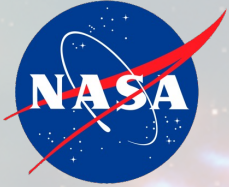
Subscribers Analysis:



Are you in our list?
 Are you in a SIG?
 Please join as we need your inputs!

Mailing List
 QR Code:





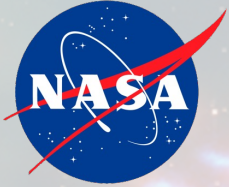
Strategic Technology Development

The Program Office

- Monitors and manages PhysCOS and COR Strategic Astrophysics Technology (SAT), Internal Scientist Funding Model (ISFM), Roman Technology Fellowships (RTF) and other direct-funded technologies;
 - Focuses on Astro2020-related technology development (FGOs, Probes); and
 - Conducts Technological Readiness Level (TRL) assessments.
-
- PhysCOS/COR Technology Website <https://apd440.gsfc.nasa.gov/technology.html>
 - Program Overview, Tech Gaps, Technology Photo Gallery, Publications
 - AstroTech Database <http://www.AstroStrategicTech.us/>
 - Published PI Annual Reports 2023
 - Astrophysics Biennial Technology Report (ABTR) 2022 & Astrophysics Technology Update (ATU)
 - Plan to publish 2024 ATU by July and 2024 ABTR and by September

21st HEAD Meeting 2024





Technology Gaps Call



- Biennial strategic technology gap prioritization process to ensure that APD invests in the right technologies.
- Reaching out to the community to help identify gaps between today's state-of-the-art technologies and what will be needed for missions & development activities prioritized by Astro2020.
- Details at https://pcos.gsfc.nasa.gov/news/2024/6_Technology_Gaps_Submissions_Due.php
 - Public webinar planned for May 14th
- Tech gaps submissions are due by June 3rd – please submit to ensure that technologies needed for PhysCOS science are well covered
- PhysPAG EC will assist in reviewing gap submissions
 - Merging similar gap submissions, updating previous gaps, editing text
 - Then hand off to the Program Office for prioritizing into tiers





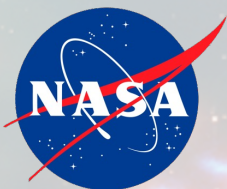
Compiling Science Gaps



GOAL: produce a list of precursor and preparatory science gaps for PhysCOS-related science as a resource for the community

- Precursor Science informs the mission architecture and trades
 - Needed soon for HWO and over coming years for X-ray/FIR future great observatories
 - Looking for natural gaps, thresholds, and gradients in the science return vs. measurement parameters
- Preparatory Science informs data / interpretation or early operations; potentially from new observations, but needed just before or soon after launch to help inform the best way to conduct investigation
- Started a process similar to the Technology Gaps process:
 - Science Gaps site with link to [google form](#) for submissions
 - Next steps: (1) review and iteration by SIGs and program office; (2) review by HQ; (3) Publish the list on PhysCOS website; (4) annually/biennially update the list





Precursor Science Gaps

- Collected community inputs on Precursor Science Gaps for HWO and FGO X-ray and IR for Precursor Science 2024 ROSES call
- 30 gaps: 15 about HWO, 5 FIR and 10 X-ray
- X-ray SIG chairs and X-ray community involved: three gaps in 2023 to ten gaps in 2024!



Gaps are listed here:



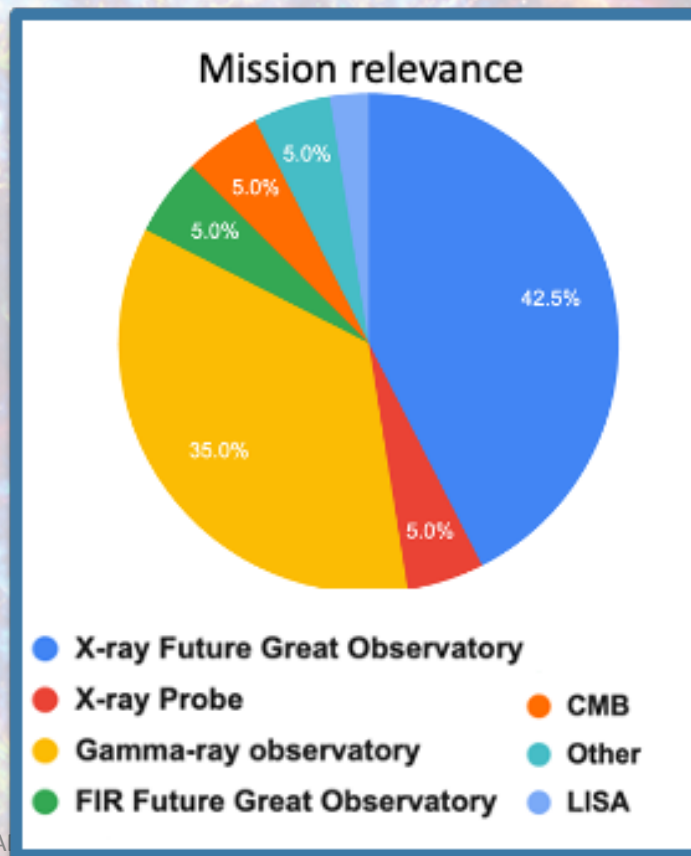
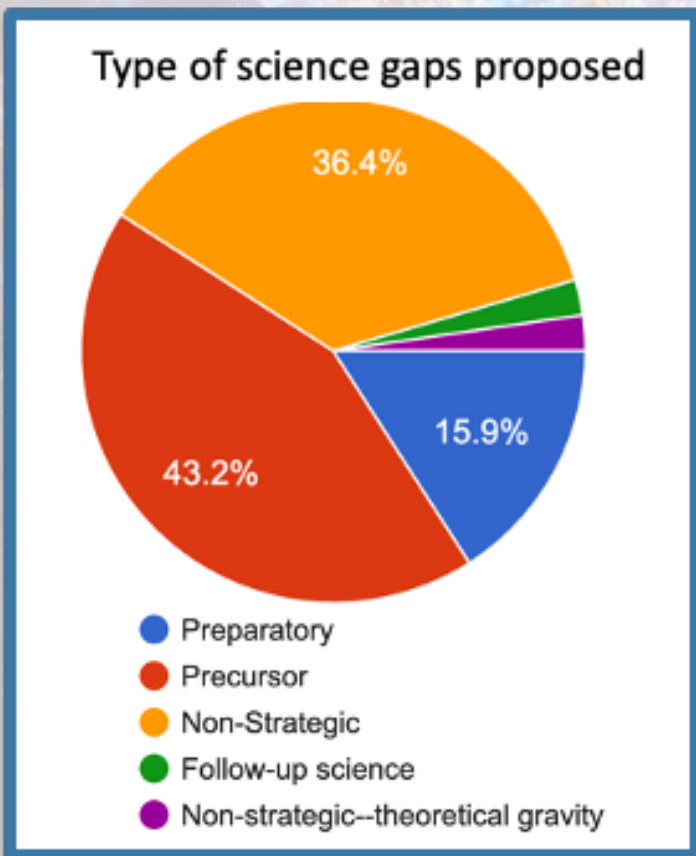
X-ray Precursor Science Gaps

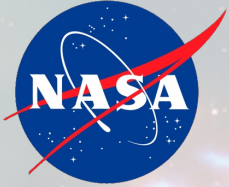
1. Black holes at the cosmic dawn: expectations for the early SMBH populations
2. Improved understanding of the relation between X-ray Binary emission, galaxy properties, and theoretical predictions
3. Probe the corona emission in Active Galactic Nuclei at hard X-ray energies
4. Theoretical modeling of High Redshift Gamma-ray Bursts
5. Blazars across cosmic time: evolution of jetted AGN and theoretical interpretation
6. Multi-messenger observations of extreme supermassive black holes
7. Understanding SMBH growth across cosmic time using black hole spin
8. Improving the Understanding of Jet Launching Regions in Astrophysical Sources
9. Modeling Feedback in Galaxy Evolution to better understand impact of magnetic fields and outflows
10. Atomic Data Needs for High-Resolution X-ray Spectroscopy



Community inputs* on Science Gaps

*As of March 2024





The Habitable Worlds Observatory



- NASA's next flagship mission concept recommended by Astro2020 Decadal Survey
- First telescope designed specifically to search for signs of life on planets outside our solar system
- HWO is perceived as an exoplanet GO but it will also conduct a **transformative** general Astrophysics program
- START an

What are the transformative astrophysics questions relevant to PhysCOS that HWO can address?

- Science
- Quant
 - Outlin
 - Develo
 - Assess the fidelity of models needed in the future to execute future trades.

- Technical Assessment Group (TAG)**
- Study architecture options.
 - Identify and assess the mission architectures and technologies needed to enable those options.
 - Evaluate the risks associated with those options.

See Eric Burns Talk



Commitment to Diversity, Equity and Inclusion

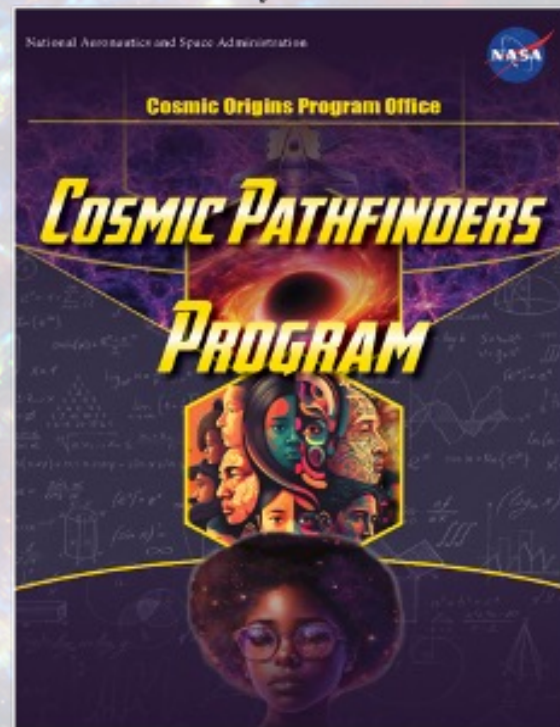
Cosmic Pathfinders Program

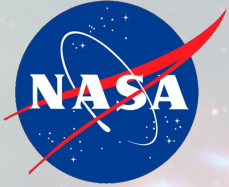
Directed by Ronald Gamble, NASA/GSFC/UMCP

Current student leadership includes:

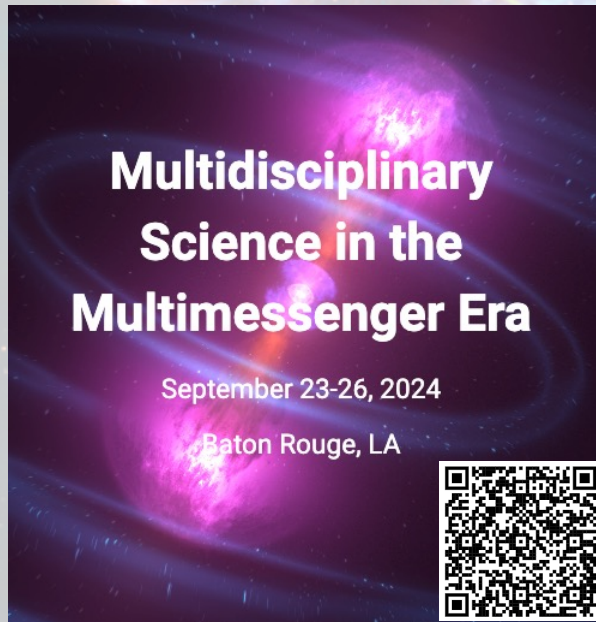
- Amethyst Barnes (NASA GSFC/CRESST-II Post-Bac, Roman/STScI)
- Jordan Forman (NASA GSFC/CRESST-II Post-Bac, FERMI)
- Gokul Srinivasaragavan (Doctoral Candidate, UMCP Department of Astronomy)
- Isiah Holt (NASA Pathways Intern & Doctoral Candidate, UMCP Department of Astronomy)
- Cosmic Chatter
 - Career Roadmap Discussion — Career pathways for Missions
 - Science Communication Panel — Communication
 - (~12) Student Presentations [March - June] — Engagement
- Hack-a-thons
 - JWST, XRISM, COSI...Roman (?), HWO (?), LISA (?), along with the potential to extend to many others.
- Professional Societies/ Conference Participation & Sessions
 - AAS, APS, NSBP, SACNAS, NSBE, SPIE, Great Minds in STEM
- University Chapters

Current student membership across the Cosmic Pathfinders footprint has eclipsed ~500 students & Early-Careers



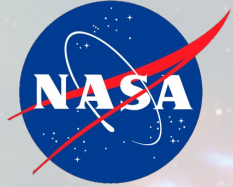


Support Conferences: 3rd TDAMM Workshop



Big Questions:

- What are the most important multidisciplinary questions of interest for TDAMM Astrophysics?
- What are the key measurements? How can we leverage current and forthcoming facilities? Do we need new ones?
- For astrophysical observations, are additional coordination recommendations needed beyond those in the [second time-domain and multimessenger white paper](#)?
- What advances are relevant for other fields of physics and national strategic priorities?
- How can multidisciplinary research be fostered?



Join our mailing list and SIG and SAG



Mailing List
QR Code:

